REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended claim 1 to incorporate therein the subject matter of each of claims 3 and 4; that is, to further define the mesophase pitch and the coal tar pitch. In light of amendments to claim 1, claims 3 and 4 have been cancelled without prejudice or disclaimer. Moreover, claim 5 has been amended to recite the further step of mixing 0.1 to 100 parts by weight of sulfur per 100 parts by weight of the pitch composition, with the pitch composition. Note, for example, the paragraph bridging pages 6 and 7 of Applicants' specification.

Applicants have amended claim 8 to further define therein the mesophase pitch and the coal tar pitch, consistent with amendments to claim 1. In light of amendments to claim 8, claim 9 has been cancelled without prejudice or disclaimer.

Furthermore, Applicants are adding new claims 10-13 to the application. Claim 10, dependent on claim 5, further defines the amount of sulfur per 100 parts by weight of the pitch composition, mixed with the pitch composition (see page 6, lines 26-28 of Applicants' specification); and claims 11 and 12, each dependent on claim 7, respectively recites that the coke is pulverized to provide a coke powder, this coke powder being subjected to graphitizing; and recites that the graphitizing forms a graphite powder (see, for example, from page 7, line 22, to page 8, line 15, of Applicants' specification). Claim 13, dependent on claim 8, recites a composition comprising the pitch composition of claim 8 and 0.1-100 parts by weight of sulfur per 100 parts by weight of the pitch composition.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the prior art applied by the Examiner in rejecting claims in the Office Action mailed April 14, 2004, that is, the teachings of the U.S. patents to Mochida, et al., No. 4,891,126, to Orac, et al., No. 5,843,298, to Hayner, No. 6,153,004, and to Ryu, et al., No. 6,521,380, and Japanese Patent Document No. 1-282346, under the provisions of 35 USC §102 and 35 USC §103.

Initially, it is respectfully submitted that in view of present amendments of claims 1 and 8, the rejection under 35 USC §102(b) in view of the teachings of No. 1-282346 is clearly moot.

As for the rejections under 35 USC §103, it is respectfully submitted that the teachings of the references as applied by the Examiner in the Office Action mailed April 14, 2004, would have neither taught nor would have suggested the presently claimed process and pitch composition, including use of the mesophase pitch produced by polymerizing a condensed polycyclic hydrocarbon or a substance containing the condensed polycyclic hydrocarbon in the presence of hydrogen fluoride-boron trifluoride, and use of the coal tar pitch containing substantially no quinoline insolubles (QI), with the composition including amounts of the mesophase pitch and coal tar pitch as in claims 1 and 8.

Furthermore, it is respectfully submitted that these references would have neither disclosed nor would have suggested such process, including the further step of mixing 0.1-100 parts by weight of sulfur per 100 parts by weight of the pitch composition, with the pitch composition, as in claim 5; or a composition including the

pitch composition according to claim 8 and sulfur in an amount of 0.1-100 parts by weight per 100 parts by weight of the pitch composition (see claim 13).

More particularly, it is respectfully submitted that these references would have neither taught nor would have suggested such process as in the present claims, including wherein the amount of sulfur mixed with the pitch composition is 1-30 parts by weight sulfur per 100 parts by weight of the pitch composition. See claim 10.

Furthermore, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested the other aspects of the present invention as in the remaining, dependent claims, having features as discussed previously in connection with the independent claims, and furthermore including (but not limited to) wherein the process includes graphitizing the coke produced according to claim 1, at a temperature of 2000° or higher (see claim 6); and/or wherein the process is a process for producing a carbon material for a negative electrode of the non-aqueous solvent type secondary battery, and includes pulverizing the coke prepared as in claim 1 and graphitizing the pulverized coke (see claim 7), particularly wherein the coke is pulverized to provide a coke powder, this coke powder being subjected to the graphitizing (see claim 11), or wherein the graphitizing forms a graphite powder (see claim 12).

The present invention is directed to processes for producing and using coke, useful in (but not limited to) forming the carbon material for a negative electrode of a non-aqueous solvent secondary battery having a high discharge capacity and high charge-discharge efficiency, and compositions useful in these processes (but not limited to use in these processes).

Mesophase pitch is an excellent carbon material capable of producing pitch coke having a high graphtizability at a high yield. However, when heat treating this mesophase pitch the pitch is foamed, such that the coke derived therefrom disadvantageously exhibits a low density. It has been desired to avoid such foaming, and various techniques therefor have been proposed, as discussed on pages 1 and 2 of Applicants' specification. However, these techniques have not been satisfactory in avoiding foaming, while also producing an artificial graphite having a high graphitization degree and high charge-discharge efficiency at initial cycles when this material is incorporated in a negative electrode of, e.g., a lithium ion secondary battery.

Against this background, Applicants provide a process for producing high-density coke from mesophase pitch, at a high productivity while avoiding foaming, and which produces a carbon material for a negative electrode of a non-aqueous solvent type lithium ion secondary battery having a high discharge capacity and a high charge-discharge efficiency. Applicants have found that when a pitch mixture containing 100 parts by weight of mesophase pitch, has included therein 10-1000 parts by weight of coal tar pitch, this pitch mixture being heat-treated at a temperature of 500°C or higher, foaming of the pitch is avoided; and when the coke is graphitized at a temperature of 2000°C or higher, it is possible to obtain an artificial graphite having a high graphitization degree. Especially advantageous results are achieved when specified mesophase pitch and coal tar pitch as in the present claims are used. Moreover, when the coke is pulverized and graphitized at a temperature of 2000°C or higher, it is possible to obtain a high-crystallinity graphite powder which can be suitably used as a carbon material for a negative electrode of a non-aqueous

solvent type secondary battery having a high discharge capacity and a high charge-discharge efficiency. Note the paragraph bridging pages 3 and 4 of Applicants' specification.

As one feature of the present invention, the pitch composition includes 10-1000 parts by weight of coal tar pitch, of the specified type, per 100 parts by weight of the mesophase pitch of the specified type. When the amount of the coal tar pitch mixed is less than 10 parts by weight, it is not possible to effectively prevent the pitch from being foamed. When the amount of the coal tar pitch mixed is more than 1000 parts by weight, the pitch is deteriorated in carbonization yield as well as graphitizability. Note the paragraph bridging pages 5 and 6 of Applicants' specification.

By mixing the coal tar pitch having a relatively low carbonization reaction rate with the mesophase pitch, viscosity of the reaction system is kept low until reaching a high temperature, thereby inhibiting the growth of foams. As a result, it becomes possible to produce the high density coke at a high yield without foaming. Note page 6, lines 16-25, of Applicants' specification.

As an additional feature according to the present invention, the pitch composition further includes sulfur in a specified amount, to further inhibit the pitch from being foamed and more effectively produce coke. Note the paragraph bridging pages 6 and 7 of Applicants' specification.

The applied Japanese Patent Document discloses a technique for production of a pitch-based carbon fiber. The technique includes hot-melt spinning of a mixture of a coal-based mesophase pitch and a petroleum-based mesophase pitch, followed by insolubilization and firing. This patent document discloses that desirably the

spinning mesophase pitch raw materials have a softening (melting?) point of 220-300°C, toluene insoluble parts of at least 70 wt.%, and optical anisotropy of at least 80 vol%. See page 4 of the English translation of this Japanese patent document prepared at the U.S. Patent and Trademark Office. This patent document discloses that for blending the petroleum type and coal type mesophase pitches, pulverization mixing or hot-melt mixing can be used; and that for the carbonization treatment, a method where its heating is done to 800°-1700°C in an inert gas atmosphere or in a vacuum can be used, and for the graphitization treatment a method wherein heat treatment is applied at 1700°C or above in an inert atmosphere can be used. Note page 4 of this English translation.

It is respectfully submitted that the applied Japanese patent document is directed to production of pitch-based carbon fiber; and that in forming this fiber a blend of coal-based and petroleum-based mesophase pitches (that is, two different types of mesophase pitches) is used. It is respectfully submitted that this patent document would have neither taught nor would have suggested a pitch composition or process as in the present claims, including, inter alia, the coal tar pitch included with the mesophase pitch, and amounts thereof, and also wherein the mesophase pitch and coal tar pitch are those as recited in the present claims. In this regard, clearly the applied Japanese patent document would have neither disclosed nor would have suggested such process or composition including, inter alia, the coal tar pitch containing substantially no quinoline insolubles, and/or the mesophase pitch produced by the specified process set forth in claims 1 and 8 as presently amended.

Furthermore, it is emphasized that the applied Japanese patent document discloses forming a carbon fiber, with hot-melt spinning being performed relatively

early in the processing (that is, after forming the mixture), and thereafter carbonization and graphitization treatments being performed. It is respectfully submitted that the disclosure of this patent would have taught away from processing as in the present invention, including, inter alia, pulverizing the coke and graphitizing the pulverized coke, as in claim 7, and in particular wherein the coke is pulverized to provide a coke powder, the coke powder being subjected to the graphitizing, as in claim 11; or wherein the graphitizing forms a graphite powder, as in claim 12.

It is emphasized that the applied Japanese patent document discloses a blend of mesophase pitches, each pitch preferably having a softening (melting?) point of 220°-300°C, more than 70 wt.% in toluene insolubles and more than 80 vol% optical anisotropy. Note that, e.g., illustratively disclosed therein is a composition of a coal-based mesophase pitch of 245°C softening (melting?) point, 83 wt.% toluene insolubles and 85 vol% optical anisotropy, blended with a petroleum-based mesophase pitch of 250°C softening (melting?) point, 79 wt.% toluene insolubles and 98 vol% optical anisotropy.

In contrast, according to the invention as presently claimed, a mesophase pitch is produced from a condensed polycyclic hydrocarbon in the presence of HF/BF_3 and is mixed with a coal tar pitch, which contains substantially no quinoline insolubles, and thereafter the mixture is subjected to heat-treatment. It is respectfully submitted that coal tar pitch used in connection with the present invention is ordinary coal tar pitch which contains substantially no quinoline insolubles. It is respectfully submitted that the coal tar pitch is isotropic and has an optical anisotropic content of 0%, as can be seen, for example, in Example 1 on pages 9 and 10 of Applicants' specification. Clearly, the blend of mesophase pitches as disclosed in the applied

Japanese patent document would have neither taught nor would have suggested the presently claimed subject matter, including components of the pitch composition (e.g., the coal tar pitch), and advantages thereof as discussed in the foregoing.

It is respectfully submitted that the secondary references applied by the Examiner would not have rectified the deficiencies of the applied Japanese patent document, such that the presently claimed invention as a whole would have been obvious to one of ordinary skill in the art.

Mochida, et al. discloses a mesophase pitch for use in the production of high-performance carbon fibers and other carbon materials. The pitch is produced by polymerizing a condensed polycyclic aromatic hydrocarbon or a substance that contains it, with the pitch having a hydrogen-to-carbon atomic ratio of from about 0.5 to about 1.0, containing naphthenic carbon in an amount of at least about 7% of the total carbon, and containing at least about 90% of an optically anisotropic phase. Note column 4, lines 40-48; see also column 4, lines 49-54, with respect to a process for producing this mesophase pitch. Note also column 5, lines 36-44 of this patent, describing starting materials for the production of the mesophase pitch; and column 6, lines 10-12, for the temperature for obtaining the mesophase. See also column 7, lines 25-38, with respect to techniques for forming carbon fibers from the pitch.

Mochida, et al. discloses a specific pitch, useful illustratively, as set forth in the patent, for producing carbon fibers. It is respectfully submitted that Mochida, et al. and the applied Japanese patent document, either alone or in combination, would have neither taught nor would have suggested the materials mixed in the process for

producing coke as in the present claims, or the materials of the pitch composition of the present claims, much less amounts of these materials as in the present claims.

Noting that Mochida, et al. is primarily concerned with forming fibers, it is respectfully submitted that the teachings of this reference together with the teachings of the applied Japanese patent document would have neither disclosed nor would have suggested, inter alia, the pulverizing and graphitizing the pulverized coke, as in various of the present claims.

Orac, et al. is concerned with a method of distilling coal tar containing quinoline insolubles (QI) solids to provide coal-tar pitch having increased QI concentration and, concurrently, a QI-free coal-tar pitch. The process is described most generally at column 2, lines 35-56, and includes use of a cross-flow filtration membrane filter and a pump to circulate continuously heated dehydrated tar to obtain (i) a substantially QI-free permeate stream exiting a circulation loop via the cross-flow filter and (ii) a QI-containing stream. This patent further discloses that in production of graphite electrodes for the steel industry, a pitch impregnate is used to fill the pores generated during initial carbonization of the carbon article, to increase final graphite product strength and density, the impregnating pitches preferably being free of QI, the QI-free permeate stream formed by the process of this patent being usable as the pitch impregnate.

Initially, note that the applied Japanese patent document is concerned with production of carbon fiber, with Mochida, et al. being primarily concerned with fibers; in contrast, Orac, et al. is concerned with production of graphite electrodes for the steel industry. Different problems are addressed in the applied Japanese patent document (that is, production of fiber free from crack on its cross section) and by

Orac, et al. In view of the different technologies involved and different problems addressed, it is respectfully submitted that one of ordinary skill in the art concerned with in the applied Japanese patent document would not have looked to the teachings of Orac, et al. In other words, it is respectfully submitted that these teachings are directed to non-analogous arts.

Furthermore, again noting the differences in technologies involved in the applied Japanese patent document and Mochida, et al., on the one hand, and Orac, et al., on the other, it is respectfully submitted that there would have been no motivation for combining the teachings of Orac, et al. with the teachings of the applied Japanese patent document and Mochida, et al.

In this regard, the conclusion by the Examiner that it would have been obvious to have modified the process of the applied Japanese patent document "by using the coal tar pitch from the process of Orac because, in the process [of the applied Japanese patent document], one of skill in the art would use any coal tar pitch including the pitch from the Orac process", is respectfully traversed. The Examiner has provided no basis for his conclusion that one of ordinary skill in the art would use "any coal tar pitch" in the process of the applied Japanese patent document; and in the absence of a basis for this conclusion, clearly the conclusion is improper.

Furthermore, even assuming, arguendo, that the teachings of Orac, et al., Mochida, et al. and the applied Japanese patent document were properly combinable, such combined teachings would have neither disclosed nor would have suggested the presently claimed subject matter, including specific components of the pitch composition and amounts of these components, and advantages achieved by the present invention due thereto. In this regard, attention is again directed to the

paragraph bridging pages 5 and 6 of Applicants' specification, showing unexpectedly better results achieved through using amounts of materials, and in particular amount of the coal tar pitch, as in the present claims. Particularly in view of these unexpectedly better results, the Examiner has not established obviousness of the presently claimed subject matter, including amounts of components of the pitch.

Hayner discloses asphalt compositions containing asphalt and sulfur, particularly for road building. This patent also discloses a method of preparing such compositions by forming a mixture of asphalt, sulfur and liquid hydrocarbon oil, which includes forming a sulfur slurry including solid sulfur and a liquid hydrocarbon oil and mixing this sulfur slurry with a polymer-free asphalt. Note column 4, lines 29-38.

Initially, it is noted that Hayner discloses forming asphalt compositions primarily for building of roads, which compositions include sulfur, the sulfur achieving marked changes in the asphalt properties, e.g., used in road building. It is respectfully submitted that one of ordinary skill in the art concerned with in the applied Japanese patent document would not have looked to the teachings of Hayner. That is, in view of the entirely different technologies involved, and different problems addressed by each, these documents are directed to non-analogous arts, such that one of ordinary skill in the art concerned with in the applied Japanese patent document would not have looked to the teachings of Hayner.

Furthermore, it is respectfully submitted that there would have been no motivation for combining the teachings of Hayner with the teachings of the applied Japanese patent document.

The contention by the Examiner that Hayner discloses that it is known to improve properties of a pitch by adding specific amounts of sulfur to the pitch is

respectfully traversed. It is respectfully submitted that the teachings of Hayner as a whole must be considered; and, contrary to the contention by the Examiner, it is respectfully submitted that Hayner discloses including sulfur with asphalt for specified purposes, particularly with respect to road building; and in light thereof one of ordinary skill in the art concerned with in the process of the applied Japanese patent document would not have looked to the teachings of Hayner.

In any event, even assuming, arguendo, that the teachings of Hayner were properly combinable with the teachings of the other references as applied by the Examiner, such combined teachings would have neither disclosed nor would have suggested the presently claimed subject matter, including mixing the specified amount of sulfur as in the present claims, and advantages thereof.

Ryu, et al. discloses a rechargeable lithium battery, having a negative electrode including a graphite-based active material with boron as a donor and a positive electrode with a transition metal oxide-based active material, a separator being interposed between the negative and positive electrodes. The positive and negative electrodes, and separator, are all saturated with an electrolyte, this electrolyte containing at least 51% by volume of cyclic carbonate and chain carbonate of 49% by volume. See column 2, lines 8-16. See also column 3, lines 21-53, for various techniques for forming the negative electrode active material.

It is again emphasized that the applied Japanese patent document is directed to a carbon fiber. In view of the differences in technology in the applied Japanese patent document, on the one hand, and in Ryu, et al, on the other, it is respectfully submitted that one of ordinary skill in the art concerned with in the applied Japanese patent document would not have looked to the teachings of Ryu, et al. Furthermore,

there would have been no motivation for combining the teachings of the applied references, including the applied Japanese patent document, with the teachings of Ryu, et al.

Moreover, it is emphasized that the Examiner has applied Ryu, et al. as disclosing pulverization of carbonaceous material before graphitizing. However, this would destroy the teachings of the applied Japanese patent application for its intended purpose, as a carbon fiber. Since the teachings of Ryu, et al., as applied by the Examiner, would destroy the applied Japanese patent document for its intended purpose, clearly this combination of teachings as applied by the Examiner is improper. See In re Ratti, 123 USPQ 349 (CCPA 1959).

In any event, even assuming, arguendo, that the teachings of Ryu, et al. were properly combinable with the teachings of the other references as applied by the Examiner, such combined teachings would have neither disclosed nor would have suggested the presently claimed invention, including specific components of the pitch composition, and amounts thereof, and advantages achieved thereby, as discussed previously.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently in the application are respectfully requested.

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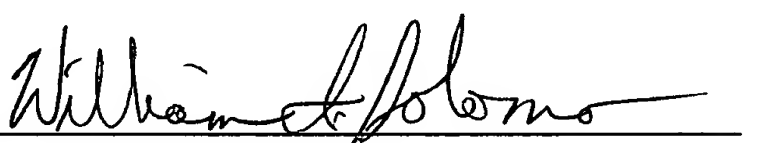
Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

By 

William I. Solomon
Reg. No. 28,565

1300 North Seventeenth Street, Suite 1800
Arlington, Virginia 22209
Telephone: (703) 312-6600
Facsimile: (703) 312-6666
WIS/sjg